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A New Insectivore from the Middle Eocene of Tabernacle Butte, Wyoming

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A special study of the geology and paleontology of the Tabernacle Butte area, Wyoming, was begun in 1950 by the University of Wyoming with the collaboration of the American Museum of Natural History and others (see McGrew, 1959). McKenna, who had briefly participated in that work in 1950, made an independent collection in 1956 that was submitted to Simpson for study in connection with the whole fossil mammalian fauna of the area (see Simpson, 1959). Among these specimens is an interesting new insectivore which was the subject of a preliminary study made by McKenna as part of wider studies of various early Cenozoic insectivores (*sensu lato*). That new form is here published by us jointly.

ORDER INSECTIVORA
FAMILY ERINACEIDAE
SUBFAMILY UNCERTAIN
SCENOPAGUS,¹ NEW GENUS

TYPE: *Scenopagus mcgrewi*, new species.

KNOWN DISTRIBUTION: Middle Eocene, Wyoming.

DIAGNOSIS: Small insectivores resembling *Metacodon* and primitive erinaceids and soricids (*Saturninia*). P³ longer than wide but triangular, with small protocone. P⁴ without separate metacone; paracone with shearing metastylar crest; incipient, low hypocone on

¹ Greek σκηνη, tabernacle, and πάγος, rock hill (= butte), from the locality of the known specimens.

posterior crest from protocone. M^{1-2} transverse, not truly quadrate, trigon somewhat compressed anteroposteriorly; small crescentic protoconule with wings to paracone base and to parastyle; small metaconule; prominent shelf buccal to paracone and metacone, especially on M^2 ; projecting parastylar and metastylar lobes, edge emarginate between them, no other styles; small hypocone as elevated lingual end of posterior cingulum, forming small lobe much more basal than protocone and without crest to any part of trigon; without separate hypocal root. M^3 apparently not reduced and with moderately strong parastylar lobe. No groove in palatal surface of maxillary bone immediately lingual to molar roots.

Scenopagus mcgrewi,¹ new species

TYPE: A.M.N.H. No. 56035, left maxilla with P^3 - M^2 and other alveoli. Collected by McKenna and presented by him to the American Museum of Natural History.

HYPODGM: The type and, with some doubt, A.M.N.H. No. 56034, fragmentary left lower jaw with M_3 , from the same excavation as the type.

HORIZON AND LOCALITY: Bridger formation, middle Eocene, near Tabernacle Butte, in Misery Quarry, University of California locality V-5628, at same level as and about 150 yards southeast of University of Wyoming locality 6 (see McGrew, 1959).

DIAGNOSIS: Sole known species of genus. Measurements are in table 1.

DESCRIPTION OF TYPE: Crowns of P^3 - M^2 are preserved. Immediately anterior to P^3 are two alveoli, in line anteroposteriorly, the posterior alveolus larger. These probably contained the roots of a single tooth, P^2 , although the possibility that they were for P^{1-2} is not wholly excluded. Anterior to these is a single alveolus, larger than that immediately posterior to it and of about the same size as the second following. This probably lodged the single root of P^1 . It is preceded by a diastema of unknown length, the alveolar border being broken off about a millimeter anterior to it, without unequivocal evidence of another alveolus.

P^3 is a small tooth, longer (anteroposteriorly) than wide (buccolingually) but with a triangular crown and probably with three small roots. The paracone is strongly crested, and there are small styles at the anterior and posterior ends of the crest, the posterior style slightly

¹For Paul O. McGrew, who directed most of the work in the Tabernacle Butte area and who, with Bryan Patterson, made the principal study of the allied form *Metacodon mellingeri*.

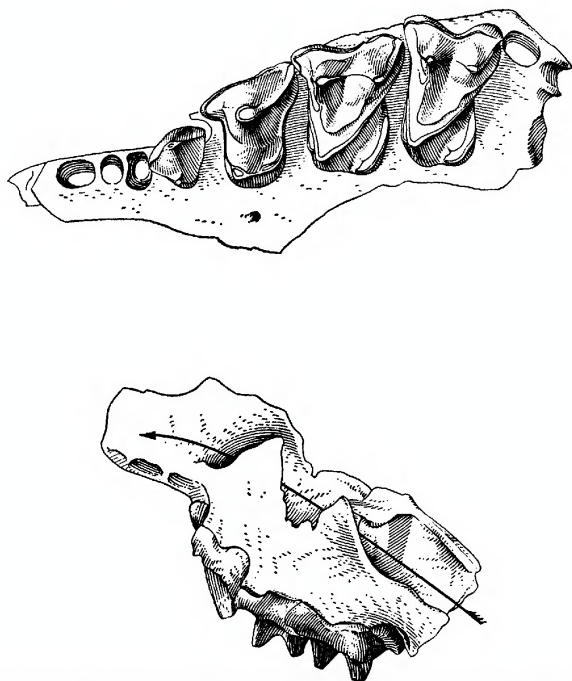


FIG. 1. *Scenopagus mcgrewi* McKenna and Simpson, 1959. Type, A.M.N.H. No. 56035, part of left maxilla with P^3 - M^2 and other alveoli, from the Bridgerian of Tabernacle Butte, Wyoming. Above, occlusal view. Below, oblique superolateral view. $\times 5$.

larger. There is no external cingulum. The small protocone, slightly posterior as well as lingual to the main cusp, is triply crested. One crest runs anterobuccally for a short distance along the anterior border, one posterobuccally to the lingual base of the paracone, and one loops posteriorly and then posterobuccally to become a posterior cingulum.

P^4 is a large tooth, markedly wider than long, similar in outline to that of *Tupaiodon* (Matthew and Granger, 1924). The stout and high paracone, with no trace of a metacone, is almost conical except for the metastylar crest that curves basoposterobuccally from the apex of the cusp to the posterobuccal point of the crown. There is a strong, crested, parastylar projection anterior (not anterobuccal) to the paracone as in *Tupaiodon* and *Metacodon*, and from the buccal base of this a crenulated cingulum runs across the buccal face of the tooth to the meta-style, which is posterobuccal to the paracone. The protocone, strong but smaller and lower than the paracone, has an anterobuccal crest continuing as an anterior cingulum to the parastyle. A second crest

connects to the base of the paracone. A third crest runs from the apex posterobasally and then turns buccally into a posterior cingulum. A swelling at the point of turning from a posterior to a buccal direction forms a small but distinct hypocone, as in *Proterixoides*.

M¹ is strongly transverse. The paracone and metacone are subequal, the metacone slightly smaller, and are nearly conical. Slight crests run anteroposteriorly between the apexes of the paracone and metacone and from the paracone apex to the parastyle. A stronger crest runs from the metacone apex to the damaged metastyle. The parastyle is like that of P⁴ but is still larger and projects more buccally. The metastyle is not completely preserved in the type specimen, but the broken root indicates that it was strongly projecting. There is a moderate shelf buccal to the paracone and metacone, with a sharp, continuous, buccal cingulum which is slightly crenulated but forms no distinct mesostyle or other intermediate styles. The buccal contour is distinctly emarginate or concave medially. The protocone is compressed anteroposteriorly and is sharply crescentic. The anterior crest runs almost directly linguobuccal to a worn but evidently definite protoconule, which was itself narrowly crescentic. The anterior crest of the protoconule runs to the parastyle anterior to the paracone, and the posterior crest runs to the linguobasal face of the paracone. The oblique posterior crest of the protocone runs to a metaconule, larger than the protoconule and not distinctly crescentic. This crest continues to run posterobuccally, posterior to the metacone, and on to the metastyle. There is a small, discrete, anterolingual cingulum, not continued around the lingual base of the protocone. A much stronger posterolingual cingulum forms a slightly projecting posterolingual lobe and rises (in an occlusal direction) to a hypocone, crested in the direction of the cingulum, and smaller and much lower (more basal) than the protocone. In contrast to advanced erinaceids, there is no distinct crest from the hypocone to either the protocone or metaconule.

M² is much like M¹ but is still more transverse, has a more buccal parastyle, less projecting metastyle, and a more emarginate external shelf.

The anterobuccal alveolus for M³ is preserved, as is part of another buccal alveolus, posterolingual to the first. The anterior edge of a lingual alveolus is possibly present, but is not well preserved. M³ was probably large, reduced slightly if at all. The positions of the alveoli suggest that it possessed a strong parastyle.

The shape and placing of the teeth and the preserved parts of the maxilla indicate a marked narrowing of the palate from M¹ forward to

TABLE 1
MEASUREMENTS (IN MILLIMETERS) OF *Scenopagus mcgrewi*
(Lengths approximately parallel to sagittal plane, widths
approximately perpendicular to sagittal plane,
diameters maximum.)

A.M.N.H. No. 56035, type	
Length	
Infraorbital canal	7.0+
P ³ -M ² , inclusive	9.3
Parastyle to metastyle, P ³	1.8
Parastyle to metastyle, P ⁴	2.8
Parastyle to metastyle, M ¹	2.8
Parastyle to metastyle, M ²	2.5 est.
Protocone to hypocone, P ⁴	1.4
Anterior cingulum to hypocone, M ¹	2.0
Anterior cingulum to hypocone, M ²	1.8
Width	
P ³	1.5
P ⁴	3.3
Parastyle to lingual wall, M ¹	3.3
Parastyle to lingual wall, M ²	3.8
Metastyle to lingual wall, M ¹	3.7 est.
Metastyle to lingual wall, M ²	3.9
A.M.N.H. No. 56034, lower jaw fragment, referred	
Depth of jaw beneath M ₃	4.0
Length of M ₃	2.7
Width of trigonid, M ₃	1.9
Width, entoconid to hypoconid, M ₃	1.5

P². This suggests that the skull was comparatively broad across the orbits but had a narrow snout.

In contrast to *Metacodon*, there is no groove in the palatal surface of the maxillary bone immediately lingual to the molar roots.

POSSIBLE LOWER TOOTH: A.M.N.H. No. 56034 is a fragment of a left lower jaw with M₃. It was found in the same excavation as the type maxilla and is suitable in size and structure to occlude with the latter, although in the absence of M³ the occlusion cannot be directly tested. The protoconid and metaconid are much elevated and subequal. The paraconid is represented by a narrow ridge from the anterior base of the protoconid almost directly linguobuccal (not anterobuccal) to a point directly anterior to the metaconid. There is a small, oblique, anterior cingulum. The talonid, narrower, longer, and much lower (more basal) than the trigonid, has three subequal posterior cusps (in contrast to advanced but not to probable primitive erinaceids). The hypocon-

ulid projects posteriorly (in contrast to advanced metacodonts) and is nearer to the entoconid than to the hypoconid. The enamel of the buccal side of the tooth extends much more basally than on the lingual side.

M₃ of A.M.N.H. No. 56034 is relatively not so reduced as in *Myolestes*, but, though almost twice as large, is in general agreement with M₃ of *Metacodon*. There are also points of agreement with M₃ of various leptictids and primitive pantolestids and with ?*Tupaiodon minor*, though the latter possesses a lower trigonid as in more advanced erinaceids.

A lower jaw with M₁₋₃ from the Morrow Creek, described by McGrew (1959) as *Diacodon edensis*, resembles the specimen just described. One of us (Simpson) believes that *D. edensis* is more likely related to *Scenopagus* than to true leptictids. It is, however, probably generically distinct and is less likely than A.M.N.H. No. 56034 to occlude well with the type maxilla of *Scenopagus mcgrewi*. Its M₃ is somewhat smaller than that just described, the trigonid less elevated, and the paraconid crest slightly more oblique.

AFFINITIES: At present only three families need be considered in this connection: Erinaceidae, Amphilemuridae, and Metacodontidae. All three families are closely related and could be considered to represent a single family, of which the metacodonts and amphilemurids would represent distinctive subfamilies, but at present all three groups are retained as separate families. Amphilemurid and metacodont ancestry can be traced back to the Paleocene, where the two groups appear to have arisen from similar basal erinaceoid stock. Amphilemurids briefly may be characterized as a group that reduced the premolars anterior to P₄ to single-rooted, procumbent teeth long before the condition was acquired by erinaceids. Metacodonts briefly may be characterized as a group of primitive erinaceoids that narrow the snout, eventually lose the zygomatic arch, develop a large lacrimal foramen, and tend towards zalambdodonty in the molars. Even in early forms there is a functional correlation between the lingual shift of the talonid cusps on P₄ and the hypertrophy of the paracone of P₄, a feature also seen in erinaceids.

Aside from characters common to the two groups, *Scenopagus* has some special resemblances to the metacodonts and some to the erinaceids, particularly (as is shown below) to *Proterix*, *Proterixoides*, and *Tupaiodon*. We here consider the latter three genera as erinaceids (*sensu stricto*), although they are distinctive in that family to the extent, at least, of lacking specializations diagnostic of Oligocene and

later unquestionable erinaceids. In the dentition these genera, with *Scenopagus*, form a series of morphological steps transitional between specialized erinaceids and specialized metacodonts. Because, however, there is evidence (mentioned below) that the metacodont line was already distinct when *Scenopagus* lived, it may be more convenient to maintain a strict definition of the Metacodontidae and to refer *Scenopagus* to a more varied array in the Erinaceidae.

No unequivocal erinaceids have hitherto been known from deposits older than Duchesnean.¹ The presence of primitive lipotyphlan insectivores in pre-Oligocene sediments has long been suspected on theoretical grounds, but thus far only a single Eocene or Paleocene probable erinaceid (*Proterixoides* Stock, 1935, Duchesnean) has been found.

European Oligocene erinaceids are unmistakably members of the same family as the late Cenozoic and Recent genera. *Galerix*, *Amphexhinus*, and *Neurogymnurus* (see Butler, 1948) are similar to modern forms. Only one Palearctic probable erinaceid, *Tupaiodon*, can truly be regarded as a connecting link with erinaceid ancestry.

Previously described American probable erinaceids are not well understood, but may be placed in several distinct groups:

A. *Meterix*: The relationship between the European *Plesiosorex* and American *Meterix* has been noted by Viret (1940) and Butler (1948). Butler (1948, pp. 491–492) places both genera in the Metacodontidae. While neither genus appears to be a metacodont, both may be regarded as late representatives of an early offshoot from erinaceid stock.

B. *Brachyerix*, *Metechinus*, and possibly *Parvericius*: These are brachycephalic forms and have been placed in the Neurogymnurinae by Butler (1948). The lineage appears to have been separate from other erinaceids since at least Oligocene time.

C. *Proterix*: *Proterix* resembles members of the subfamily Erinaceinae in the short face and loss of P¹. It resembles members of the subfamily Echinisoricinae in the shape of M³ (presumably the Eocene ancestry of the Erinaceinae had such an M³, however) and in the pos-

¹ *Entomolestes* Matthew, 1909, now known from Tiffanian, Wasatchian, and early Bridgerian deposits, is listed by Simpson (1945) as an echinosoricine erinaceid. McKenna (in press) has removed *Entomolestes* from the Echinisoricinae and placed the genus in the family Amphilemuridae Heller, 1935. Several other North American Eocene genera are also placed in that group. The amphilemurids may or may not be deserving of family rank distinct from the Erinaceidae. The question will be discussed elsewhere. If the amphilemurids are of family rank rather than a subfamily of the Erinaceidae, *Scenopagus*, if correctly referred, is the earliest known member of the Erinaceidae.

session of a completely ossified palate. There is no close resemblance to American genera referred to the subfamily Neurogymnurinae by Butler (1948). Matthew (1903) states that P^4 is molariform, but this is probably not correct. The anterobuccal root is probably for the parastyle, the posterobuccal for the paracone. P^4 possesses a strong, isolated hypocone. All the teeth are markedly wider than long. Butler (1948, p. 488) notes that the nasals of this genus extend farther back than in other erinaceids in which these bones are known. This distinctive feature is also found in *Metacodon* (McKenna, in press). We agree with Butler (1948) that *Proterix* may be near the ancestry of the Erinaceinae, but until truly primitive erinaceine material is discovered in Eurasia the exact affinities of *Proterix* within the family Erinaceidae will continue to be puzzling. The genus is perhaps descended from ancestors with a morphology similar to that of *Tupaiodon* or *Proterixoides*.

D. *Proterixoides*: In keeping with its antiquity (Duchesneau), this genus is the least like modern erinaceids of the American fossil forms. The hypocone of P^4 is barely separated from the protocone, as in *Scenopagus*. The metastylar crest of P^4 is weak. In M^1 and M^2 the hypocone is not connected to the trigon by an anterobuccally directed crest. The lower premolars are somewhat amphilemurid-like, but P_3 is double-rooted.

The following may be regarded as primitive erinaceid features of *Scenopagus*:

A. P^3 and especially P^4 possess the characteristically erinaceid basoposterobuccally directed metastylar crest from the paracone apex (also present in *Metacodon* but in P^4 of that form the crest is overshadowed by the hypertrophied paracone).

B. P^4 possesses a hypocone closely similar to that of *Proterixoides*. The hypocone of P^4 in *Tupaiodon* is similar, although somewhat more widely separated from the protocone. In *Galerix* and more advanced erinaceids the hypocone of P^4 is a large cusp well separated from the protocone, giving the tooth the familiar quadrate outline.

C. In M^1 and M^2 the hypocone is not connected to the protocone or metaconule by an anterobuccally directed crest. This and the preceding (B) are in agreement with probable primitive (*Tupaiodon*, *Proterixoides*) but not with advanced erinaceids.

D. M^1 and M^2 of *Scenopagus* are not so transverse as in leptictids, primitive pantolestids, or *Metacodon*. They rather resemble those of the most primitive probable erinaceids in outline, but are less quadrate than in typical specialized erinaceids.

E. The metaconule of M^1 and M^2 is larger than the protoconule.

F. The infraorbital canal is long, as in primitive erinaceids, but in contrast to that of *Metacodon* and all advanced lipotyphlans.

Members of the family Metacodontidae Butler, 1948, of which the Oligocene genus *Metacodon* is the best-known form,¹ show many similarities to *Scenopagus*, but *Scenopagus* is not regarded here as a metacodont, though both it and the metacodonts are believed to be primitive lipotyphlan insectivores and at least to this extent are closely related. Metacodonts closely similar to *Metacodon* itself were already present in Bridgerian time (McKenna, in press) and suggest that a common ancestry of the metacodonts and primitive erinaceids may have been present as early as, or before, the beginning of the Eocene.

The metacodont skull is known from Oligocene material only. It may therefore be argued that Eocene metacodonts may not have possessed all the specializations seen in *Metacodon* itself. This is indeed partially true, in that the narrow snout and perhaps some of the associated structures in *Metacodon* appear to have evolved only after Bridgerian time. The lower cheek teeth of an undescribed Bridgerian metacodont are almost identical with those of *Metacodon* (McKenna, in press). This fact permits the interpretation that metacodonts with many of the features seen in *Metacodon* were already present in the record at the same time as or prior to the occurrence of *Scenopagus*.

The following specializations occurring in *Metacodon* are not possessed by *Scenopagus*:

A. All the upper molars of *Metacodon* possess a strong hypoconal root, even in M^3 where the hypocone is weak or absent. The Echinosoricinae generally possess a separate hypoconal root on P^4 - M^2 . In M^3 the hypoconal root is fused with the metaconal root. *Galerix* is exceptional in that only M^1 and M^2 possess a separate hypoconal root. In the Erinaceinae and Neurogymnurinae P^4 - M^3 possess only one lingual root, as in *Scenopagus*.

B. A large subdivision of the major palatine artery and the associated long and deep groove present on the palatal surface of the maxillary bone just mediad from the molar roots in *Metacodon* are not present in *Scenopagus*.

C. *Metacodon* shows incipient zalambdodonty. P^4 of *Metacodon* pos-

¹ See Scott and Jepsen (1936), Clark (1937), Patterson and McGrew (1937), Clark (1939), Butler (1948), Simpson (1951), and Galbreath (1953) for details concerning the cheek teeth of *Metacodon*. A recently discovered fragmentary skull of *Metacodon* greatly increases our knowledge of the group. A discussion of this and other pertinent material will be published by McKenna elsewhere.

sesses a remarkably high paracone that occludes successfully with the buccal surface of the talonid of P_4 only because the talonid has become greatly reduced and its cusps have shifted far linguad to make room for the occluding paracone. The Bridgerian genus *Myolestes* (probably a metacodont) shows this type of P_4 (Yale Peabody Museum No. 13609; McKenna, in press), and the same structure may be seen in an undescribed Bridgerian metacodont (Yale Peabody Museum No. 13619; McKenna, in press). While the hypertrophied P^4 of *Metacodon* differs from that of *Scenopagus* and later erinaceids, nevertheless the metacodont condition is doubtless derived from the more generalized structure still retained by *Scenopagus* and later erinaceids. In the upper molars the stylar shelf of *Metacodon* is wide in M^2 and especially so in M^1 . This is in contrast with *Scenopagus*, in which the stylar shelves of M^1 and M^2 are not so pronounced. In *Metacodon* the paracone and metacone of the molars are moderately appressed, as in primitive leptictids. M^3 is unlike that of primitive erinaceids in that it is antero-posteriorly compressed and has reduced the metacone and conules, and possesses a distinct hypoconal crest (Patterson and McGrew, 1937, p. 259), but the large parastyle is perhaps in agreement with the condition postulated for *Scenopagus*. M^3 is not preserved in known material of *Scenopagus*, but alveoli for its roots indicate that a moderately large parastyle was present, in contrast to later erinaceids but perhaps in agreement with *Metacodon*, primitive pantolestids, leptictids, and others.

Most of the characters in which *Scenopagus* differs from the metacodonts may be interpreted as generalized features that would be expected to occur in the ancestors of the metacodonts, the latter being regarded as specialized from the morphology of basal erinaceoid stock. For this reason it is difficult to determine whether *Scenopagus* is a primitive erinaceid or a late representative of the primitive metacodonts. Only one important specialization of *Scenopagus* precludes derivation of metacodont morphology from that seen in *Scenopagus*; one of the anterior upper premolars, probably P^1 , has become single-rooted. In metacodonts and primitive erinaceids (e.g., *Galerix*) all the anterior upper premolars are present and are double-rooted. In the Erinaceinae P^1 was eliminated at an early date. In the Echinisoricinae P^1 becomes single-rooted as in pantolestids and leptictids. In *Galerix* the roots of P^1 are occasionally united (Butler, 1948, p. 467).

Saturninia Stehlin (1941), described as a sorcid from the Ludian of Vacluse, also resembles *Scenopagus* to some extent, but has a very different development of the hypocones of P^4 - M^2 . This is a distinct

foreshadowing of the exaggerated development seen in later shrews, such as *Sorex* itself. Despite numerous important differences, *Saturninia* is the soricoid most similar to *Scenopagus* and other primitive erinaceoids.

SUMMARY

Scenopagus is regarded as a very primitive erinaceid differing significantly from advanced members of the family, yet possessing a morphology that is in general structurally ancestral to advanced erinaceids. To a considerable extent *Tupaiodon* (Oligocene, Mongolia) bridges the gap between advanced forms and *Scenopagus*, but *Tupaiodon* occurs too late in time to have been actually intermediate. P⁴ is similar in *Scenopagus* and *Proterixoides*, which present the earliest known examples of this characteristic erinaceid tooth. The hypocones of the molars are quite different from those of advanced erinaceids, but intermediate morphology is demonstrated by *Proterixoides* and *Tupaiodon*. The transverse nature of the molars is another primitive feature, but again *Tupaiodon* bridges the gap.

The broad cingular shelf, strong parastyle and metastyle, and emarginate buccal edge of the molars are similar to the corresponding structures in *Metacodon* and may indicate fairly close relationship to the Metacodontidae. The metacodonts probably originated from primitive erinaceids similar to *Scenopagus* but possessing two lingual upper molar roots as in the Echinisoricinae.

REFERENCES

- BUTLER, P. M.
1948. On the evolution of the skull and teeth in the Erinaceidae, with special reference to fossil material in the British Museum. Proc. Zool. Soc. London, vol. 118, pp. 446-500, figs. 1-28.
- CLARK, J.
1937. The stratigraphy and paleontology of the Chadron formation in the Big Badlands of South Dakota. Ann. Carnegie Mus., vol. 25, pp. 261-350, 12 figs., 6 pls.
1939. Status of the Oligocene insectivore genus *Metacodon*. Jour. Paleont., vol. 13, pp. 139-140.
- GALBREATH, E. C.
1953. A contribution to the Tertiary geology and paleontology of north-eastern Colorado. Paleont. Contrib. Univ. Kansas, Vertebrata, art. 4, pp. 1-120, pls. 1-2, figs. 1-26.
- HELLER, F.
1935. *Amphilemur eocaenicus* n. g. et n. sp., ein primitiver Primate aus dem Mitteleozän des Geiseltales bei Halle a. S. Nova Acta Leopoldina, new ser., vol. 2, pp. 293-300, 1 fig., 1 pl.

MCGREW, PAUL O.

1959. The geology and paleontology of the Elk Mountain and Tabernacle Butte area, Wyoming. *Bull. Amer. Mus. Nat. Hist.*, vol. 117, pp. 117-176.

MCKENNA, MALCOLM C.

- [In press.] Fossil Mammalia from the early Wasatchian Four Mile fauna, Eocene of northwest Colorado. *Univ. California Publ. Bull. Dept. Geol. Sci.*

MATTHEW, W. D.

1903. A fossil hedgehog from the American Oligocene. *Bull. Amer. Mus. Nat. Hist.*, vol. 19, pp. 227-230, 1 fig.
1909. The Carnivora and Insectivora of the Bridger Basin, middle Eocene. *Mem. Amer. Mus. Nat. Hist.*, vol. 9, pp. 291-567, figs. 1-118, pls. 42-52.

MATTHEW, W. D., AND W. GRANGER

1924. New insectivores and ruminants from the Tertiary of Mongolia, with remarks on the correlation. *Amer. Mus. Novitates*, no. 105, pp. 1-7, 3 figs.

PATTERSON, B., AND P. O. MCGREW

1937. A soricid and two erinaceids from the White River Oligocene. *Field Mus. Nat. Hist., geol. ser.*, vol. 6, pp. 245-272, 15 figs.

SCOTT, W. B., AND G. L. JEPSEN

1936. The mammalian fauna of the White River Oligocene. Part I. Insectivora and Carnivora. *Trans. Amer. Phil. Soc.*, new ser., vol. 28, pp. 1-153, 7 figs., 22 pls.

SIMPSON, G. G.

1945. The principles of classification and a classification of mammals. *Bull. Amer. Mus. Nat. Hist.*, vol. 85, pp. i-xvi, 1-350.
1951. American Cretaceous insectivores. *Amer. Mus. Novitates*, no. 1541, pp. 1-19, 7 figs.
1959. A new middle Eocene edentate from Wyoming. *Amer. Mus. Novitates*, no. 1950, pp. 1-8.

STEHLIN, H. G.

1941. Zur Stammesgeschichte der Soriciden. *Eclog. Geol. Helvetiae*, vol. 33, pp. 298-306, 5 figs.

STOCK, C.

1935. Insectivora from the Sespe uppermost Eocene, California. *Proc. Natl. Acad. Sci.*, vol. 21, pp. 214-219, 1 pl.

VIRET, J.

1940. Étude sur quelques erinacéides fossiles (suite) genres *Plesiosorex*, *Lanthanotherium*. *Trav. Lab. Géol. Univ. Lyon*, vol. 39, mém. 28, pp. 33-65, 8 figs., 1 pl.